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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Federal-State Joint Board on Universal Service	)	CC Docket 96-45
	)	
Forward-Looking Mechanism for High Cost Support for Non-Rural LECs.	)	CC Docket 97-160

JOINT COMMENTS OF BELLSOUTH CORPORATION, BELLSOUTH TELECOMMUNICATIONS, INC., US WEST, INC., AND SPRINT LOCAL TELEPHONE COMPANIES TO FURTHER NOTICE OF PROPOSED RULEMAKING SECTIONS III.C.1

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I. INTRODUCTION

There are an abundance of issues to consider in evaluating the appropriate methodology to use in calculating the forward-looking economic costs incurred by non-rural carriers in the provision of universal service support. Unarguably, one of the most important elements of any cost model is the manner in which it accounts for the size of serving areas over which those costs are spread.

With that in mind, BellSouth, US West and Sprint - the Joint Sponsors of the Benchmark Cost Proxy Model ("BCPM") - have enhanced BCPM in a manner consistent with the Commission's stated goals for how its eventual cost model should determine customer location. In point of fact, the Joint Sponsors submit that the enhancements made to BCPM go beyond merely correcting the problems identified by the Commission with both the previous version of BCPM as well as the Hatfield model on this issue. As will be described in more detail in the comments provided below, the enhanced BCPM offers a customer location algorithm which will select the appropriate granularity of analysis to assure that customers are accurately located and moreover, that the cost outputs are representative of the network design which, in reality, is necessary to serve those customers.

Unlike Hatfield Model 4.0, the BCPM's customer location algorithm addresses the recognized deficiency of the Census Block Group as an engineering unit in rural areas. Instead, by going to the CB or grid level, BCPM now reflects the reality of rural areas; that is, that people are not necessarily dispersed equally throughout the CBG. Using BCPM's enhanced algorithm, the Commission will be able to overlay wire centers with grids, thereby eliminating areas with no population and concentrating instead on road miles where people are more likely to be located.

As will be described in more detail below, the Joint Sponsors believe that BCPM's the use of actual data to determine the location of customers will permit network costs to be more accurately measured, which, in turn, will allow high-cost support to ultimately be more efficiently targeted.

II. BCPM ENHANCEMENTS

Prior to addressing the specific questions posed by the Commission in its Further Notice of Proposed Rulemaking, the Joint Sponsors offer the following description of the enhancements made to BCPM with respect to customer location. It should be noted that, in the comments to be provided on September 24, 1997 in response to the FCC's FNPRM's inquiries regarding the local loop, the Joint Sponsors intend to expand upon how this new methodology for locating customers is critical to ensuring a network design that neither overbuilds nor underbuilds the network in connecting customers to that network. The enhanced BCPM will integrate more precise information regarding customer location with a clustering algorithm that reflects an efficient network design, given technological constraints.

The previous version of BCPM, BCPM1.1, based customer location on Census data at the Census Block Group (CBG) level. BCPM1.1 assigned CBGs to wire centers based on whether the centroid, i.e. geographic center, of the CBG fell within the wire center boundaries provided by On Target's "Exchange Info Plus" data product. This all or nothing CBG assignment resulted in a significant number of misassignments of customers to wire centers, as well as misassignments of customers to their respective local exchange carrier.

The enhanced BCPM will utilize Census data at the Census Block (CB) level. CBs reflect customer location at a much more granular level than CBGs.[1] This increased level of granularity will provide greater assurance of truly locating customers and assigning customers to the proper wire center. Additionally, the enhanced BCPM's use of wire center boundaries provided by Business Location Research (BLR) will increase the accuracy in assigning customers to their actual serving wire center.

The enhanced BCPM recognizes that telephone plant engineers do not typically build plant on a customer by customer basis. Rather, they plan and build plant based on Carrier Serving Areas (CSAs)[2] and Distribution Areas (DAs). Thus, engineers recognize actual clustering of customers when implementing standard engineering practices that try to maximize the efficient use of plant, minimize the distribution portion of plant, and ensure adequate service quality. One of the major challenges of building a proxy model is clustering customers in a fashion that integrates engineering practices based on this CSA and DA approach.

[1] On average, there are approximately 30 CBs within a CBG. The number of CBs that comprise a CBG typically decreases as the density (households per square mile) increases.

[2] A CSA is that portion of a local loop extending from a digital loop carrier (DLC) site to the distribution area interface.

The BCPM1.1 and earlier versions, including BCPM1.0, Benchmark Cost Model 2 (BCM2), and BCM, as well as Hatfield 4.0 and its earlier versions, used the CBG as the unit of engineering area. Our analysis indicates that CBGs have substantial deficiencies as a modeling unit. These deficiencies exist mainly in rural areas, precisely those areas that a high cost fund typically targets. In these sparsely populated areas, CBGs tend to be rather large and odd in shape, and provide no information about where customers are truly located.

To adjust for these deficiencies, the modelers of both BCPM and Hatfield developed various approaches to recognize the actual location of customers. BCPM1.1 used a road reduction approach that reduced the area engineered to a 500-foot buffer along each side of roads within the CBG. Hatfield uses a town clustering approach that assumes a given percentage of rural customers reside in town (typically 85%). Hatfield assumes that the customers in town are located in 2 or 4 sub-clusters where customers live on contiguous 3-acre lots. Furthermore, Hatfield assumes that the remaining customers (typically 15%), are located 150 feet from a few road cables that emanate from these sub-clusters. Attachment B, "An Analysis of the Hatfield 4.0 Model Customer Location Algorithm," provides an extensive analysis of Hatfield's clustering approach.

However, neither the BCPM1.1 nor the Hatfield 4.0 rural approaches captured actual customer location with adequate accuracy. Given this dilemma, the BCPM developers recognized the need to create an innovative approach that could locate accurately customers in all areas. To accomplish this, the enhanced BCPM introduces a reformulated geographic entity - the dynamic grid.

Recall that the Cost Proxy Model (CPM) used a 1/100 of a degree longitude and latitude grid. This standardized the geographic unit of measure for modeling, simplified the engineering algorithms, removed the modeling errors from "squaring"

CBGs, and allowed the roll-up of the geographic grid entity into almost any entity desired by the user. The enhanced BCPM will further enhance the CPM's flexible grid approach by combining it with CSA and DA engineering constraints. The resulting grid unit is dynamic in the sense that this grid will vary in size to ensure that the number of customers included in a grid takes into account CSA and DA guidelines. Furthermore, the maximum grid size is constrained so that the limitations of copper distribution are not exceeded.

To illustrate the rural data and the various approaches to locating rural customers, Attachment A, Figure 1, provides satellite maps for six random CBGs in the lowest density group, i.e. less than five housing units per square mile. Note the variability in the degree of clustering across these CBGs. Attachment A, Figures 2 and 3, provide the comparison of Hatfield Model 4.0's, BCPM1.1's, and the enhanced BCPM's characterization of customer location for two of these 6 CBGs. Although this is not representative of all rural areas, these areas were randomly selected and seem to demonstrate the enhanced BCPM's superiority in locating customers.

The following discussion provides highlights of the enhanced BCPM methodology employed in generating the appropriate grid configuration associated with a given wire center. In general, a series of reaggregation steps subsequently combines grids into various sizes, consistent with an efficient network design. Each grid's size, cost characteristics, and number of lines is integrally linked to telephone engineering CSAs and DAs. In addition, the construction of these grids will take into account the actual road network to more accurately reflect the location of customers within a CB. Documentation is still under development which will provide greater detail regarding this process.

a. Methodology

The first step in accurately establishing customer location is the specification of the appropriate wire center boundaries. In BCPM1.1, wire center boundaries were established based on the aggregate area of CBGs whose centroids were assigned to that particular wire center. In contrast, the enhanced BCPM will rely on wire center data obtained from BLR. Attachment A, Figure 4, compares actual wire center boundaries with the wire center boundaries of BCPM1.1 and the new BCPM for the, Iowa wire center.

The second step is to use the CB level of data that falls within the corresponding wire center boundary. Attachment A, Figure 5, depicts CBs within the Waukon, Iowa wire center. The number of telephone lines required for a wire center clearly depends on the size and number of CBs located within a given wire center. The Bureau of the Census establishes CB boundaries based on roads and natural borders such as rivers. The CB data that provides household and housing unit line counts reflect 1990 Census data that have been updated based upon 1995 Census statistics regarding household growth by county. The enhanced BCPM also uses business line data obtained from PNR and Associates (PNR). Although some of the business lines are defined only at the Census Tract and CBG level,[3] PNR has assigned successfully, approximately 85% of the business customers to specific CBs.

The final step is the creation of the variable size grids from the CB data within the wire center boundaries. Attachment C, "BCPM Data Specifications: the GIS Data," provides greater detail regarding the grid algorithms. The purpose of developing variable size grids is to simulate the basic telephone plant engineering units of a CSA and DA. A CSA typically contains 1,000 to 1,600 lines, while a DA typically contains 400 to 600 lines. Additionally, a CSA is comprised of a group of DAs.

[3] This is typical of attempts to geocode customer locations based on address data.

b. The Grid Process

Phase I: Establishing Microgrids and Corresponding Data

This process is necessary to aggregate population into areas that can be utilized as telephone engineering CSAs and DAs. There are two phases of the grid process. The first phase entails assigning CB data to micrograms. "Microgrid" refers to the smallest grid size used in the grid process. A micrograms is $1/200^{th}$ of a degree latitude and longitude. This corresponds to approximately 1,500 feet by 1,700 feet[4]. The entire serving wire center is partitioned into micrograms. Thus, each CB within the serving wire center is overlayed with micrograms (unless the entire CB falls within a single grid). Smaller CBs, typically located in the denser, urban areas, are aggregated into micrograms while larger CBs located in the rural areas may span multiple micrograms.

Since household and business line data are assigned at the CB level, this process requires apportioning CB line data to the corresponding micrograms. Two approaches are used to apportion this data to the micrograms, depending on the size of the CB. For CBs whose area is less than ¼ of a square mile, (2,640 feet by 2,640 feet), encompassing approximately three to four micrograms, household and business line data will be apportioned based on the land area of the micrograms used relative to the CB's total area.[5]

[4] Due to the curvature of the earth, these dimensions vary depending on the latitude and longitude where they are derived. These measurements are used only to give the reader a sense of relative size.

[5] For a micrograms that is fully encompassed by a CB, i.e. 100% of the micrograms's area is encompassed within the CB, the area covered by that one micrograms is (1,500ft. x 1,700 ft) = 2,550,000 sq. ft. If the total area of the CB is 5,100,000 sq. feet, then the fraction of land area of the CB encompassed by that micrograms is(2,550,000sq ft. /5,100,000sq. ft.) = .5 of the area. Thus, ½ of the household and business line data is apportioned to that micrograms.

If only a portion of a micrograms is encompassed by the CB, e.g. 80% of the micrograms is encompassed by the CB, then the area covered by that one micrograms is .8x(1,500ftx1,700ft) = 2,040,000 sq. ft. If the area of the CB is 5,100,000sq. ft., then (2,040,000 sq. ft./5,100,000 sq. ft.) =.40 In this case, .4 or 2/5ths of the household and business line data is apportioned to the micrograms.

For CBs with an area greater than ¼ of a square mile, household and business line data will be apportioned based on relative road lengths using actual road data obtained from TIGER/Line files [Topologically Integrated Geographic Encoding and Referencing from the US Census Bureau]. That is to say, the line data will be apportioned based on the road length contained within a microgrid that traverses that CB, relative to the total road length within that CB. Since roads are used to locate customers, certain roads where customers are unlikely to reside, have been excluded from the road data.[6] To illustrate the apportionment of household and business line data to microgrids based on relative road lengths, assume that the total road length associated with a particular CB is 60 miles and that 20 of those miles traverse a particular microgrid. Since (20 miles / 60 miles) = .333, 1/3 of the household and business line data will be associated with that particular microgrid. At the end of phase one of the grid process, the total census housing and PNR business line data associated with a wire center have been apportioned to each of the microgrids comprising that serving wire center.

c. The Grid Process

Phase II: Reaggregating Microgrids into Appropriate Grid Sizes

The second phase of the grid process entails aggregating these microgrids into larger grids as appropriate. The ultimate size of the larger grids depends upon housing and business line data and technological constraints on the reasonable size of CSAs and DAs. The largest ultimate grid size allowed is 1/25th of a degree latitude and longitude in size or approximately, 12,000 to 14,000 feet per side. This was established to comport with the engineering constraint that the maximum copper distribution length

[6] For example, road data used in the new BCPM excludes Limited Access Roads, Highway Ramps, Roads in Tunnels, Logging Trails, and Private Drives. The BCPM Developers will provide a detailed list at a later date.

cannot exceed 12,000 feet.[7] Hereafter, grids 1/25th of a degree latitude and longitude are referred to as macrogrids.

At first blush, it may seem reasonable to start with microgrids and expand them as appropriate to satisfy technological constraints. However, such an approach results in a large number of remaining microgrids dispersed among larger grids. To reduce the potential for isolated microgrids, the enhanced BCPM will establish fixed grid boundaries by overlaying macrogrids upon the microgrids. A total of 64 microgrids constitutes a macrogrid. These macrogrid boundaries constitute the maximum size grid associated with each respective group of 64 microgrids.

The ultimate grid size utilized essentially reflects the manner in which customers are clustered. Modeling grids that vary in size is tantamount to allowing clusters of customers associated with a particular CSA and DA to vary in density and dispersion.

The algorithm for determining the ultimate grids is actually a multistage process built to satisfy engineering constraints, minimize processing time, and simplify computer code. Although the following intuitive exposition of the grid algorithm is computationally different from the code, it is analytically equivalent. The derivation of grids can best be explained as an iterative process where partitioning occurs if the number of lines within a grid is too large, or if other technological constraints become binding. The macrogrid is partitioned into smaller grids, if warranted, based on household and business line data associated with the underlying microgrids, and CSA and DA guidelines. The iterative process partitions the macrogrid into four equally sized subgrids. In some instances, these subgrids, which are 1/50th of a degree latitude and longitude in size, become the ultimate size for that composite of microgrids. In

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[7] This is subject to the caveat that if, due to placement of a digital loop carrier (DLC) or re-aggregation of partial grids (discussed later), the length of a distribution cable exceeds 12,000 feet, cable gauge adjustments may be made to accommodate distribution cable lengths up to 18,000 feet.

other instances, the number of lines within a subgrid is still too large. In those instances, additional sub-partitioning occurs for the subgrids. Additional sub-partitioning continues to occur until all grids satisfy line size and technological constraints. The smallest grid allowed is the 1/200th of a degree latitude and longitude, the microgrid. The resulting ultimate grids have a composite household and business line count equal to the sum of the household and business lines for the associated underlying micrograms. The ultimate grids for Waukon, Iowa and Red Oak, Iowa are depicted in Attachment A, Figures 6 and 7, respectively.

It is possible that, after completing this iterative process, small groups of microgrids remain, with less than 100 lines associated with each group, that do not warrant placement of a CSA and/or a DA within a group. Such small groups of microgrids are aggregated with those ultimate grids of equal or larger size, located closest to the road centroid of each small group of microgrids.

Partial grids arise from grids that intersect the wire center's boundaries. Partial grids with line demand less that 100 and smaller than 1/5th of a macrogrid in area, and therefore, not supportive of a CSA and/or a DA for that partial grid, are aggregated with the adjacent grid that constitutes the longest border along that partial grid. This process is repeated for each macrogrid within the wire center boundaries.

d. Establishing Quadrants Within Each Grid

Once the ultimate grids have been established, each ultimate grid[8] is segmented into four quadrants. Each quadrant represents a potential DA. The latitude and longitude coordinates of the quadrants are determined by first establishing the road centroid of the grid.[9] Quadrants within the ultimate grid are centered on this road

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[8] Since no data is defined below the microgrid level, the microgrid cannot be segmented into quadrants.

[9] The road centroid is calculated by as the average horizontal and vertical point of all roads in the defined area.

centroid. (See Attachment A, Figure 8, for an illustration of distribution plant.) Within each quadrant, another road centroid is established. If a quadrant does not contain any roads, that quadrant is simply treated as an empty quadrant. For each non-empty quadrant, the total area that falls within a 500-foot buffer along each side of the roads within that quadrant is calculated. A square distribution area equal to that total area is established for these non-empty quadrants. The center of each quadrant's square DA is placed at the road centroid of the quadrant. Such an approach provides a reasonable model of the required telecommunications network facilities for two reasons. First, households and businesses typically reside near roads and centering the quadrant of the distribution area about the center of the roads establishes network facilities closer to where customers are located than does the centroid of the quadrant. Second, rights of way for telecommunications structure generally exist near roadways. This approach reduces requisite network facilities, given customers' actual location.

III. COMMENTS ON THE FURTHER NOTICE OF PROPOSED RULEMAKING

In response to the Commission's specific questions on the customer location platform design, the Joint Sponsors offer the following comments:

a. Geographic Unit

In the Universal Service Order, the FCC concluded that any cost study or model must calculate support at least at the wire center serving area level, and, if feasible, for even smaller areas such as a CBGs, CBs, or grid cells to permit targeting. BCPM and Hatfield base all cost calculations on CBGs. Should the FCC adopt an area smaller than a CBG? ¶ 40

Comment:

In order to accurately determine the cost of serving customers in rural, insular and high cost areas it will be necessary to go below the level of the CBG. These are precisely the areas where costs are the highest, and the need for accurately targeting the support is the greatest. Since a CBG varies in size to capture, on average, 400 households, the size and shape of the CBGs can vary drastically. Therefore, knowing where within the CBG customers are located will have a profound impact on the cost of serving customers and the amount of support required. Costs will vary depending on whether customers are uniformly distributed across the CBG, or are clustered in one small area. It is thus important that the selected costing methodology examine a smaller geographic unit than the CBG. Ideally, the geographic unit utilized should be at a level at which the costs of serving customers within it does not differ significantly. This should also tie closely with the Telephone engineering Distribution and Carrier Serving Areas.

Determining the geographic area to which the support derived from this cost study will be targeted is, however, more complicated. Clearly targeting support to the study area, as we do today, is not the answer. Targeting support to the wire center is easy to administer and allows a better ability to direct support to higher cost areas, but creates the problem of low-cost main streets. Even in the highest cost wire centers, there are customers who are low in cost to serve - those located close to the central office. If we target support to the wire center, providers will be given support for these lower cost customers which greatly exceeds the cost to serve them in the first place. This will create perverse incentives for carriers to come in and seek out these lower cost customers to gain an unwarranted windfall. Assuming carriers act upon these incentives, any windfall will occur at the expense of higher cost customers, whose support would be lower than was actually necessary due to cost averaging at the wire center level.

The enhanced BCPM provides policy-makers the flexibility to target high cost support in a manner which is both economically and administratively efficient.

Ideally, the level at which costs are developed should equal the level at which subsidies are determined. In the enhanced BCPM's case, this would be at the grid level. However, it may be impractical (albeit not impossible) to locate each and every customer into one of the BCPM grids. Therefore, several alternatives may be viable. It must be kept in mind, however, that these alternatives may sacrifice accuracy for ease of administration. Alternatives could include distributing support by CBG, by zones within the wire center, by zip code (or zip plus four), or some other alternative methodology. However, the Joint Sponsors believe that the results obtained from the enhanced BCPM may mitigate the need for any further analysis.

Would using CBGs, CBs, or grid cell data allow a more accurate calculation of the cost of providing universal service and better targeting of support? ¶ *40*

Comment:

The Joint Sponsors believe that integrating customer location information at the CB into the grid cell level, as utilized in the enhanced BCPM, clearly permits a substantially more accurate determination of cost. Incorporating information regarding customer location at the CB level as opposed to the CBG level enhances the ability to locate customers by an order of magnitude. This is critical to ensuring that adequate network facilities are placed so that all customers can actually be connected to the network. But locating the customer is merely the first step in determining the cost of providing service to those customers. It is important that the network be designed efficiently, so that the cost of serving customers in high cost areas is minimized. The level of the data should be selected so as to minimize the algorithm's tendency to overbuild or underbuild the network. As described herein, the Joint Sponsors are proposing a robust customer location algorithm in the enhanced BCPM which will select the appropriate granularity of analysis to assure that customers are accurately located and costs are representative of the efficient network design which is necessary to serve these customers.

b. Distribution of Customers

BCPM uses a uniform customer distribution algorithm, which assumes that customers are spread evenly across an entire CBG. In rural areas, BCPM eliminates areas from the CBG data that are more than 500 feet from any road, based on the assumption that households are located within 500 feet of a road. ¶ 41

Hatfield uses a clustering algorithm. It first removes the empty space within each CBG by removing CBs when census data indicates that they do not contain any population. In low-population density CBGs, Hatfield clusters 85% of the population within a town. For dense areas, Hatfield establishes two clusters if more than 50% of the CBG is empty and four clusters where 50% or less of the CBG is empty. In CBGs where the line density is so high that customer locations must be "stacked," Hatfield assumes that the population lives in multi-unit dwellings. ¶ 42

Because population clustering actually occurs, the assumption that the population of a CBG is uniformly distributed across the CBG may distort the model result. ¶ 44

Comment:

After years of studying the distribution of customers in remote areas for the development of ever-improving cost proxy models, the Joint Sponsors are convinced that customer distribution patterns are unique. In some cases (particularly in flat-terrain agricultural areas) customers are uniformly distributed across the CBG. In other cases, the vast majority of customers are clustered in a single small location. In other cases there may be two, three, four or more clusters of customers in various locations throughout the CBG.

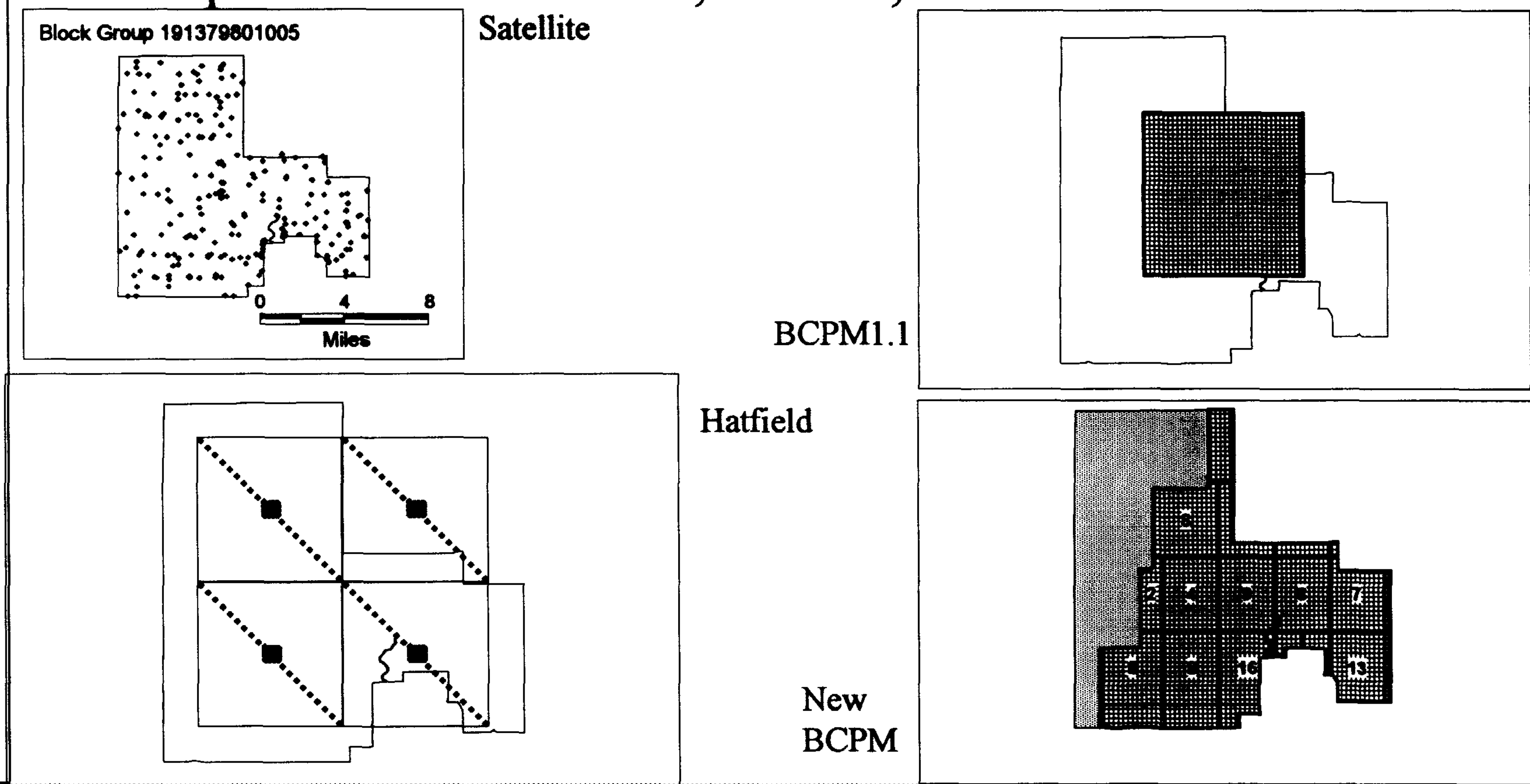
In the original Benchmark Cost Model filed in 1995, the assumption was made that customers were uniformly distributed across the CBG. While correct in some cases, it was clearly wrong for many others. In those areas where distribution was not uniform, BCM likely misstated cost. In BCM2, the land area was reduced to remove areas which were not within 500 feet of a road, and costs were computed assuming uniform distribution across this reduced land area.

The Hatfield 4.0 model imposes a clustering algorithm on those CBGs in the three lowest density zones and on those CBGs that are greater than 50% empty in the remaining six density zones. This clustering algorithm, as explained below, results in a network that in fact does not exist. Consequently, Hatfield Model 4.0 does not connect the vast majority of customers in rural areas to the network.

The Hatfield Model 4.0's clustering algorithm uses a town factor to assign the fraction of the population within a given CBG that lives in town. The default value for the Model is 85% - in other words, the Model assumes that 85% of customers are located in a town. Although Hatfield 4.0 allows users to alter the town factor for each CBG, this does not remedy the substantial underestimation in costs of serving those customers in low density, high cost areas, nor does it ensure that those customers in town are actually connected to the network. Indeed, costs in Hatfield Model 4.0 are fairly insensitive to changes in the town factor. The fundamental problem with the town factor is the placement of the customers within the town. Hatfield assumes that the customers in town are located on contiguous three-acre lots. Imposing such a constraint on lot size compresses customers into a tiny fraction of the populated area. Thus, the algorithm does not adequately account for the actual dispersion of customers within the CBG, nor within a town inside the CBG. (Attachment B provides a detailed analysis of Hatfield Model 4.0's clustering algorithm.)

BCPM Enhanced Customer Location

- Comparison of BCPM1.1, HM4.0, And Enhanced BCPM



Any Representation of data is for illustrative purposes only.

BCPM Enhanced Customer Location

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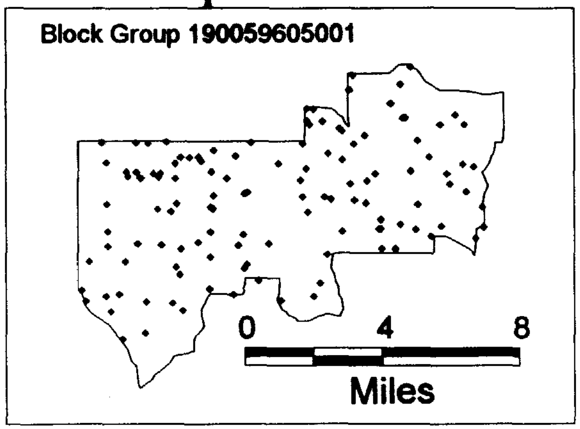

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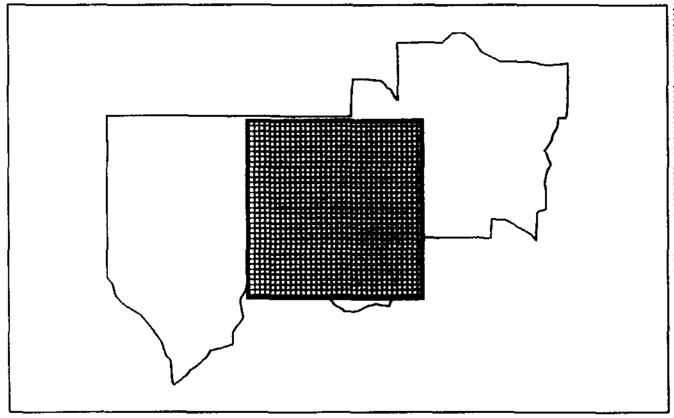
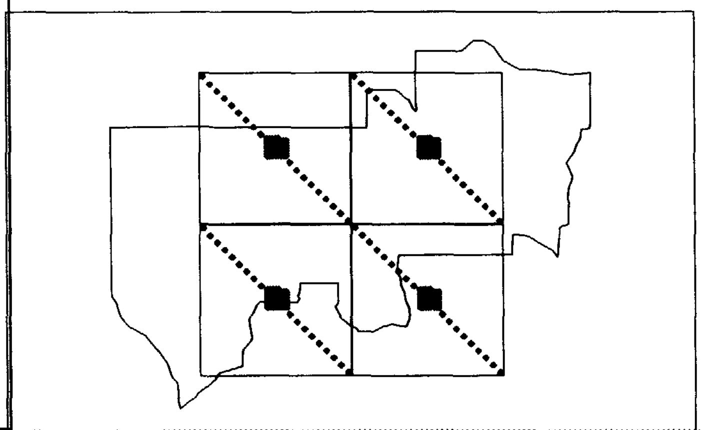
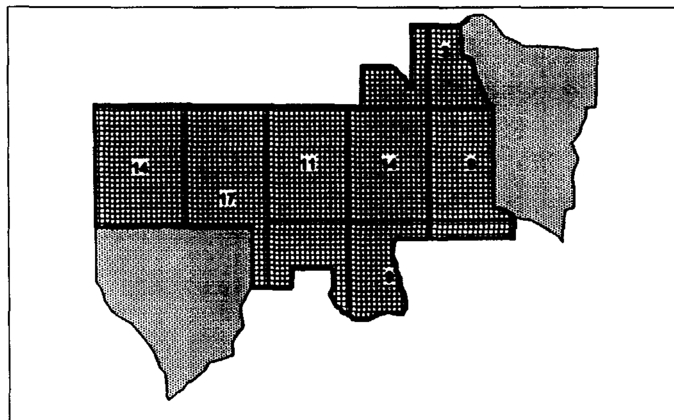


BCPM1.1



Hatfield



New BCPM

Any Representation of data is for illustrative purposes only.

The enhanced BCPM methodology, using variable size grids, accurately determines population clusters and dispersion patterns by examining census block data, road network data, and business location data for each of its variable-sized grids. This data provides an accurate proxy for the basic engineering units of telephone distribution areas and carrier serving areas.

The following two figures illustrate the impact of the enhanced BCPM methodology for two small rural communities. Figure A represents Red Oak, Iowa, while Figure B represents Waukon, Iowa, each of which are shown within the boundary of the CBG for that area. The drawing in the upper left-hand corner reflects the actual location of customers based upon satellite photographs. The figure in the upper right shows how BCPM1.1 would have reduced the CBG area to a square shape and reduced the area to eliminate geography not within 500 feet of a road. The lower left figure illustrates the Hatfield 4.0 method utilizing four clusters and road cables. The figure in the lower right shows how the enhanced BCPM will locate customers within the wire center. (Note that significant portions of the CBG are actually served by different wire centers.)

□ EMBED Word.Picture.6 □□□

□ EMBED Word.Picture.6 □□□

The FCC tentatively concludes that a clustering algorithm would more accurately distribute customers within some CBGs and would generate more accurate estimates of loop length and the cost of outside plant. ¶ 44

Comment:

The Joint Sponsors agree that, conceptually, a clustering algorithm has the potential to more accurately distribute customers within some CBGs and to provide more accurate estimates of loop length and the cost of outside plant. However, it is imperative that the clustering algorithm is designed appropriately. The enhanced BCPM's integration of actual CB data, actual road network data, and variable grid-size methodology results in a clustering algorithm that achieves the objectives of substantially greater precision in locating customers and increased accuracy in estimating loop length and outside plant costs. It must be remembered that, the BCPM grid was designed to replicate a telephone plant engineering area following standard Carrier Serving Area (CSA)/ Distribution Area (DA) architecture.

The Hatfield clustering algorithm assumes that within each CBG (approximately 400 households) there is a town which contains 85% of the customers (roughly 340 households) with the remaining (60) households clustered along (150 feet from) road cables that emanate out from the central cluster. The design of an efficient forward-looking network does not and can not imply the rearrangement of customer locations for network efficiency. The enhanced BCPM algorithms will locate customers where they really live, and assure sufficient explicit support to assure the continued provision of affordable service.

FCC tentatively concludes that, if a model assumes that customers are clustered, the accuracy of the position of the population cluster relative to the wire center is important to an accurate prediction of the necessary support amount. ¶ 44

Comment:

The Joint Sponsors agree with the Commission's tentative conclusion. The location of customers relative to the central office is absolutely critical in the design of the outside plant. Generally, the central office is located in a town or other dense concentration of customers. The CBGs surround the town, and are relatively small in the urban and suburban areas, and gradually bigger the further one gets from the town and the central office. The location of the CBG relative to the central office, and the location of population clusters (if any) relative to the CBG boundaries will impact the cost of feeder and distribution facilities. The size of the outlying CBGs makes it more difficult for modelers to accurately assign customers to their correct serving wire center. A large rural CBG may, in fact, be served by multiple wire centers, thus assigning the entire CBG to a single wire center ensures inaccuracies.

In order to more accurately model the geographic relationship of customers and their actual serving wire centers, the Joint Sponsors are using a Business Location Research-provided wire center boundary data base and geographic areas of variable size grids. This allows the BCPM to more accurately reflect wire center boundaries and establish the correct serving arrangement for each customer.

FCC tentatively concludes that the model should calculate the proximity of population clusters to wire centers with more precision than the current models permit. ¶ 44

Comment:

The Joint Sponsors concur in the Commission's tentative conclusion and as explained herein, the enhanced BCPM will accommodate this change.

How can the BCPM's uniform distribution algorithm and Hatfield's clustering algorithm be modified to provide more accurate customer location information? ¶ 44

Comment:

The Joint Sponsors believe that the grid cell methodology described earlier will provide more accurate information on customer locations, and provide for the accurate and efficient targeting of high-cost support.

How can the accuracy of both BCPM and Hatfield be improved in assigning CBGs to serving wire centers? ¶ 44

Comment:

The Joint Sponsors believe that they have made two significant improvements which will greatly improve the accuracy in assigning customers to the appropriate serving wire centers. First, we have selected a new vendor of Wire Center boundaries that we believe accurately represents the actual wire center boundaries. Second, we have stepped down to Census Block level data. Therefore, BCPM can more specifically and accurately assign geographic areas to wire centers.

Are there alternate methods, other than those currently used by BCPM and Hatfield, to locate population in carrier serving areas? ¶ 45

Comment:

Yes. The Joint Sponsors believe that our proposals as reflected in the enhanced BCPM will greatly improve the accuracy of locating customers and designing networks.

Should loop lengths be more closely linked with actual loop statistics? ¶ 45

Comment:

At best, loop statistics provide data on the average length of loops in a central office. Since there are generally many more shorter loops than longer loops, it is questionable what value these loop statistics would have for high-cost support targeting. These loop statistics could provide, however a tool for validating the results of proxy models. To the extent that the average loop length within a wire center as predicted by the proxy model varied significantly from the loop length statistics, this would raise questions either as to the validity of the model, or the validity of the loop statistics themselves. Any significant variance would require investigation.

Would a method that combines actual geographical maps, census data, and the location of the serving wire centers better estimate customer location, and therefore costs, than the algorithms currently used by BCPM and Hatfield? ¶ 45

Comment:

The Joint Sponsors believe that our proposed enhanced methodology will address these concerns.

Would the following proposal be a more accurate method to estimate the distribution of customers?

For the residential population, census data provide the number of households with a CB as well as internal point coordinates and polygon vertex coordinates. What currently available commercial mapping software, if any, could be used to identify the location of customers in all CBs within a service territory? ¶ 46

Comment:

The enhanced BCPM methodology provides an accurate means of locating customers into variable size grids. Once the wire center boundaries overlay the grid assignment of customers, the correct assignment of customers to service area is accomplished.

Should a model impose a uniform grid over an ILEC's service territory in order to create subscriber population clusters, determining the size of the cluster according to the technology constraints of electronic systems that are used to provide universal service, such as Asymmetric Digital Subscriber Line (ADSL) and High bit rate Digital Subscriber Line (HDSL) technologies, rather than basing cluster sizes on census data? ¶ 46

Comment:

The question seems to imply that the modeling effort can base cluster sizes on census data or it can base cluster sizes on technological constraints, but that a model cannot base it on both simultaneously. The Joint Sponsors disagree with such an implication. The enhanced BCPM demonstrates that clustering based on both census data and technological constraints can in fact be achieved. BCPM's clustering algorithm integrates information regarding population clusters based on census data, and in particular CB data, with the ability to vary grid size in a manner that appropriately reflects technology constraints. Varying the grid size permits the model to establish appropriate distribution and feeder facilities based on technological constraints of a forward-looking network.

How does this proposal compare with the methods employed by BCPM and Hatfield? ¶ 46

Comment:

As indicated in the response to the previous question, the enhanced BCPM effectively attains the objectives of the proposal to account for technological constraints when determining cluster size.